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EXAMINER	
MILLER, RYAN J	
ART UNIT	**PAPER NUMBER**
2621	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/592,750	Applicant(s) TOYAMA, KENTARO	
	Examiner Ryan J. Miller	Art Unit 2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 March 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-47* is/are pending in the application.

4a) Of the above claim(s) *44-47* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,13-22,28,29 and 33-37* is/are rejected.

7)☒ Claim(s) *11,12,23-27,30-32 and 38-43* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 June 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The response received on March 19, 2004 has been placed in the file and was considered by the examiner. An action on the merits follows.

Response to Arguments

2. Applicant's arguments filed March 19, 2004 have been fully considered. A response to these arguments is provided below.

Prior Art Rejections

35 U.S.C. 102(b) rejections

Summary of Argument: The applicant argues that the Office Action has incorrectly characterized an alleged capability of Wren et al. (the article titled "Pfinder: Real-Time Tracking of the Human Body") to automatically learn a color-based object model from a combination of generated state estimates and image observations (see applicant's remarks: page 3, paragraph 3). The applicant further argues that section 3 of Wren et al. states the case of tracking a person where finder has already found and built representations of the person and the scene, and therefore, can not describe learning such models (see applicant's remarks: page 4, paragraph 1). The applicant also argues that in section 4 of Wren et al., the actual creation of the "person model" is explained by describing a system which begins with some known or predefined contours corresponding to known parts of the human and then iteratively updated (see applicant's remarks: page 6, paragraph 1).

Examiner's response: The examiner disagrees. Although it is correct that the system disclosed by Wren et al. begins with some known or predefined contours, the claim language does not exclude such information from being used since the claims use open-ended claim

language. In section 4.2 of Wren et al., it is described that the Pfinder system builds up a blob model of the person. Therefore, the limitation, "automatically learning the color-based object model using the state estimates and the observations" is met by the reference as will be further described in the rejection below.

35 U.S.C. 103(a) rejections

Summary of Argument: With regard to the rejections of claims 8, 10, 13, 14, 17, 18, and 20-22, the applicant argues that the Wren-Birchfield combination still fails completely to disclose the applicant's claimed element of automatically learning color-based object models (see applicant's remarks: page 10, paragraph 3).

With regard to claims 9, 36, and 37, the applicant argues that the Wren-Birchfield-Koller combination still fails completely to disclose the applicant's claimed element of automatically learning color-based object models (see applicant's remarks: page 11, paragraph 3).

Examiner's response: The examiner disagrees. As described above, Wren et al. discloses automatically learning the color-based object model using the state estimates and the observations. Therefore, each of the combinations discloses this feature.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-7, 15, 16, 19, 28, 29, 33-35 rejected under 35 U.S.C. 102(b) as being anticipated by Wren et al. (the article titled "Pfinder: Real-time Tracking of the Human Body").

As applied to claim 1, which is representative of claims 15 and 16, Wren et al. discloses a system for tracking at least one object in at least one sequential image, comprising: a general purpose computing device (see page 6, section 8: The reference describes the use of a 200 MHz R4400 processor Indy with Vino Video (i.e. a general purpose computing device).); and a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program to: (a) generate a state estimate defining probabilistic configurations of each object for each sequential image (see page 2, section 3.1: The reference describes determining a the blob spatial characteristics of an object in an image. This corresponds to generating a state estimate defining probabilistic configurations (see equation (1)).); (b) generate observations of pixel color for each sequential image (see page 4, section 4.2: The reference describes measuring the Mahalanobis distance of new pixel values in color space from the appropriate location in the scene (i.e. generating observations of pixel color).); (c) automatically learn a color-based object model using the state estimate and the observations (see page 4, section 4.2: The reference describes that the Mahalanobis distance (i.e. color observations) and blob size (i.e. state estimates) are used by the Pfinder system to build a model of the person. This the Pfinder system performs these steps independently of operator intervention, the system automatically learns the model.); and (d) automatically track each object using the learned color-based model with a color-based tracking function (see page 3, section 3.3: The reference describes the use of an analysis loop to track an object in an image based on the person model (i.e. color-based model) using tracking functions described by the equations (4), (5), and (6).).

As applied to claim 2, Wren et al. discloses that generating the state estimate comprises determining the probabilistic configurations of each object using an initial image processing program module (see section 8: The reference describes the use of a 200 MHz R4400 processor Indy with Vino Video. This computer has all of the program modules including an initial image-processing unit).

As applied to claim 3, Wren et al. discloses that the initial image processing program module employs a tracking system comprising a tracking function in combination with an object model for probabilistically detecting object configuration information (see page 3, section 3.3: The reference describes that the tracking system uses a likelihood function (equation (5)) (i.e. a tracking function) in combination with the blob models (i.e. object models) for detecting object configuration information.).

As applied to claim 4, Wren et al. discloses that the initial image processing program module employs a contour-based tracking function in combination with a contour-based object model for probabilistically detecting object configuration information (see page 3, section 3.3: The reference describes the use of connectivity constraints (i.e. contour-based tracking function).).

As applied to claim 5, which is representative of claim 19, Wren et al. discloses that generating the observations of pixel color comprises collecting pixel color information over the entirety of each image (see page 3, section 3.2: The reference describes that a model of the scene is generated that is partially based on the color distribution of each pixel in the image.).

As applied to claim 6, Wren et al. discloses that generating the observations of pixel color comprises collecting pixel color information over specific portions of each image (see page 2,

section 3.1: The reference describes that each blob (i.e. specific portions of each image) has a color component.).

As applied to claim 7, Wren et al. discloses generating the observations of pixel color employs the state estimate to identify specific relevant regions of each image over which pixel color information will be collected (see page 2, section 3.1: The reference describes that each blob has a spatial characteristic (i.e. state estimate) which identifies a relevant region in the image. A color component is determined for each spatial characteristic.).

As applied to claim 28, Wren et al. discloses that generating the state estimate comprises processing each image with an initial object model and an initial tracking function (see page 2, section 3: The reference describes a "steady-state" case in which the system has built representations of a person (i.e. an initial object model and tracking function) and uses them to initialize the system (i.e. generate the state estimate).).

As applied to claim 29, Wren et al. discloses that the initial object model is iteratively replaced with the learned color-based object model and the initial tracking function is replaced with a color-based tracking function to improve the accuracy of the learned color-based object model (see page 3, section 3.3: The reference describes that the person models are continuously updated (i.e. iteratively replaced) to improve the accuracy of the learned color-based object model.).

As applied to claim 33, Wren et al. discloses a process for gathering the sequential images (see page 6, section 8: The reference describes the use of a single CCD, color camera for gathering the sequential images.).

As applied to claims 34 and 35, which merely disclose a computer-readable memory comprising a computer program comprising program modules that perform the processes of claims 15 and 28, Wren et al. discloses such a computer-readable memory since a computer performs all of the processing in Wren et al.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 8, 10, 13, 14, 17, 18, and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wren et al. (the article titled "Pfinder: Real-Time Tracking of the Human Body") and Birchfield (the article titled "Elliptical Head Tracking Using Intensity Gradients and Color Histograms"). The arguments as to the relevance of Wren et al. in the rejection of claims 1 and 15 above are incorporated herein.

Claims 8, 10, 13, 14, 17, 18, and 20-22 call for the use of histogram processing when generating the color observations. Wren et al. describes that color observations are taken into account when determining the object model; however, the reference does not disclose the use of histogram processing. Birchfield, in the same field of endeavor of object tracking and the same problem solving area of modeling objects using color, describes the use of such histogram processing as detailed below with reference to each of the claims.

As applied to claim 8, which is representative of claim 21, Birchfield discloses that generating the observations of pixel color comprises automatically generating a first probability

distribution function modeled using a first histogram to represent a range of observed pixel colors (see section 4: The reference describes the use of a histogram for generating color observations of the object. A histogram, as described in the claim, is a probability distribution function.).

As applied to claim 10, which is representative of claim 22, Birchfield discloses program module for automatically learning the color-based object model automatically computes a second probability distribution function modeled using a second histogram to represent a background for each image (see section 4: The reference describes forming an image histogram, which is a histogram of the entire image minus the model (i.e. a background image). Also, as described above, a histogram is a probability distribution function.).

As applied to claim 13, Birchfield discloses that automatically learning the color-based object model comprises performing a bin-by-bin comparison between the first histogram and the second histogram (see section 4: The equation for determining Φ_c performs a bin-by-bin comparison between the model histogram (i.e. the first histogram) and the image histogram (i.e. the second histogram).).

As applied to claim 14, Birchfield discloses that bins in the first histogram having values exceeding corresponding bins in the second histogram correspond to those color ranges representing the learned color-based object model (see section 4: The reference describes that the equation for determining Φ_c is used, in part, to represent the color-based object model.).

As applied to claim 17, Birchfield discloses that a confidence measure is associated with the observations of pixel color (see section 4: The reference describes that an offline, as well as an online, histogram is obtained. The offline histogram is used as a confidence measure that the

online histogram (i.e. observations of pixel color) is actually a histogram representation of the head.).

As applied to claim 18, Birchfield discloses that the observations of pixel color are weighted in proportion to the confidence measure (see section 4: The equation Φ_c is used to weight the online histogram (i.e. observations of pixel color) by the values of the offline histogram (i.e. the confidence measure).).

As applied to claim 20, Birchfield discloses that the observations of pixel color are collected over specific portions of each image wherein the state estimate has a probability greater than a minimum threshold level (see section 4: The reference describes determining a model histogram by counting the pixels inside the ellipse (i.e. collecting pixel color information over specific portions of each image). The ellipse corresponds to the state estimate. Therefore, an ellipse will only be formed if the state estimate exists, so the state estimate has to have a probability greater than zero (i.e. a minimum threshold level).).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Wren et al. by adding the use of histogram processing as described in Birchfield because the use of such processing steps allows for the color measure to be "more satisfied with a region containing both facial and hair color than a region containing all facial color" (see Birchfield: section 4). Therefore, the tracking system would provide more accurate results since color observations are made for more then just the facial color.

7. Claims 9, 36, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wren et al. (the article titled "Pfinder: Real-Time Tracking of the Human Body") and Birchfield (the article titled "Elliptical Head Tracking Using Intensity Gradients and Color

Histograms") and further in combination with Koller et al. (the article titled "Using learning for approximation in stochastic processes"). The arguments as to the relevance of Wren et al. in the rejection of claims 1 and 34 above are incorporated herein.

Claims 36 and 37 call for the representation of pixel color information and background image information to be determined using a probability distribution function. This element is absent from Wren et al. but is described in Birchfield (see section 4: The reference describes using a histogram (i.e. a probability distribution function) to represent the model (i.e. pixel color information) and the image (i.e. background information).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Wren et al. by adding the use of probability distribution functions to represent color as taught in Birchfield because the use of such processing steps allows for the color measure to be "more satisfied with a region containing both facial and hair color than a region containing all facial color" (see Birchfield: section 4). Therefore, the tracking system would provide more accurate results since color observations are made for more then just the facial color.

Claim 9, as well as claims 36 and 37, calls for the use of a Dirichlet function. The combination of Wren et al. and Birchfield does not teach the use of a Dirichlet function; however, Koller et al., in the same field of endeavor of image processing, and the same problem solving area of object tracking, describes the use of such a function (see column 10: The reference describes the use of a Dirichlet prior for use with a multinomial distribution.).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the combination of Wren et al. and Birchfield by adding the use of

a Dirichlet function as taught by Koller et al. because the use of a Dirichlet function "serves to 'spread out' some of the probability mass over unobserved states, increasing the amount of exploration done for unfamiliar regions of the space" (see Koller et al.: column 11).

Allowable Subject Matter

8. Claims 11, 12, 23-27, 30-32, and 38-43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan J. Miller whose telephone number is (703) 306-4142. The examiner can normally be reached on M-F 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on (703) 305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ryan J. Miller
Examiner
Art Unit 2621

Ryan J. Miller

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